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STRUCTURE FOR EXHAUST GAS PURIFICATION
[Haiki gasu jōka yō kōzōbutsu]

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Specification

1. Title of the invention

Structure for exhaust gas purification

2. Claims

(1) A structure for exhaust gas purification, provided with a ceramic honeycomb having numerous cells in its interior, a buffer material which is wrapped around the exterior of said ceramic honeycomb, and a metal container which encloses said buffer material and has exhaust gas inlets on the front and back of the aforesaid ceramic honeycomb, said structure for exhaust gas purification characterized by the fact that at least the surface of the aforesaid buffer material that is in contact with the ceramic honeycomb is subjected to corrugation processing.

(2) A structure for exhaust gas purification according to Claim 1, characterized as having as a principal constituent a blended composition of an inorganic fiber, quartzite, and an organic binder.

(3) A structure for exhaust gas purification according to Claim 1, characterized by the fact that numerous holes are formed inside the plane of the buffer material.

(4) A structure for exhaust gas purification according to Claim 1, characterized by the fact that numerous grooves are formed inside the plane of the buffer material.

3. Detailed Explanation of the Invention

(Industrial Field of Application)

The present invention relates to a structure for exhaust gas purification used in catalytic converters and filters which purify exhaust gas from internal combustion engines.

(Prior Art)

In recent years, in order to purify the exhaust gas from internal combustion engines, catalytic converters and/or filters which use honeycomb form ceramics have been installed in the exhaust pipes. These ceramic honeycombs are formed by extrusion molding or corrugation winding of the ceramic material. Catalytic converters oxidize the hydrocarbons and carbon monoxide contained in exhaust gas and are mainly used in gasoline engines; they are formed by carrying a catalyst of a precious metal such as platinum on a ceramic honeycomb having a comparatively fine cell density. Filters are used mainly for diesel engines and remove particulates (smoke) in the exhaust gas. They are formed by sealing one end of a cell of a ceramic honeycomb having a comparatively coarse cell density with a high cavity ratio and the other end of the cell contiguous thereto with plugs, forcing the exhaust gas inside to pass out through the cell walls. In both cases the ceramic honeycomb is wrapped in an inorganic fiber mat or metal mesh that has been subjected to liquid processing, and is housed in a metal container having connection openings for the exhaust gas in the front and back.

(Problems that the Invention is to Solve)

When a product using a ceramic honeycomb of this type is placed in the exhaust gas stream of an internal combustion engine, it is subjected

to back pressure due to the air passage resistance, and the ceramic honeycomb is pressed backward. Hence, the aforesaid buffer material is not only for the purpose of protection from mechanical vibrations from external sources, but also serves the purpose of tightly surrounding the ceramic honeycomb. Nevertheless, in order to enclose the ceramic honeycomb with force that resists back pressure, it is necessary to use a buffer material which is hard and has a high density. On the other hand, when a high-temperature exhaust gas flows through the ceramic honeycomb and particulates are collected therein and are ignited, heat is radiated outward through this buffer material, and a significant pressure differential occurs between the center portion and periphery of the ceramic honeycomb. For this reason, the peripheral area is subjected to high levels of tensile stress due to the internal thermal expansion. Thus, the ceramic becomes unable to withstand this stress, and annular cracks referred to as ring-off occur on the peripheral area.

The present invention has the object of offering a structure for exhaust gas purification in which the ceramic honeycomb is securely held inside the container, annular cracks do not occur, or even when the center portion is heated to a high temperature, the original form of the structure is maintained, and an effective exhaust gas perfect function is achieved.

(Means of Solving the Problems)

The present invention is constituted so that a thick sheet composed mainly of the organic fibers and organic binder and having numerous fine holes or numerous fine grooves on its surface is formed, the outer periphery of the ceramic honeycomb which has the function of exhaust gas

purification is wrapped in this sheet as a buffer material, and this ceramic honeycomb is connected to the engine exhaust pipe by compression in the circumferential direction from above the sheet.

(Operation)

According to this constitution, by means of the numerous fine holes or grooves formed on the surface of the buffer material, the frictional force with the peripheral surface of the ceramic honeycomb is increased, and the pushing of the ceramic honeycomb downstream by the back pressure of the engine can be avoided. Moreover, since the buffer material is processed so as to have numerous holes or grooves, its density as a whole is reduced. Accordingly, the degree of heat transmission toward the periphery is relatively low, and even if the ceramic honeycomb is heated by high-temperature exhaust gas from the engine or high-temperature combustion gas, the radiation heat into the outer air via the container is blocked, so the temperature differential produced inside is low. As a result, the thermal stress generated on the peripheral area of the ceramic honeycomb is low, and deformation such as the occurrence of cracking inside does not occur.

(Working Examples)

Next, a working example of the exhaust gas purification structure of the present invention is explained referring to the attached drawings.

Figure 1 shows a longitudinal cross section of a structure for exhaust gas purification used as a filter for the removal of particulates contained in the exhaust gas of diesel engines when it is connected to the exhaust pipe of the engines (not shown in figure). In

the figure, reference numeral 1 denotes a tubular ceramic honeycomb. The ceramic honeycomb 1 is a structure composed of cell walls 3 which constitute cells 2 (2a, 2b) forming rectangular flow paths inside. One end of the cell 2a and the other end of the adjacent cell 2b are mutually sealed by means of a plug 4. After the buffer material 5 has been wrapped around the outside of the ceramic honeycomb 1, it is housed inside a container 6 made of heat-resistant stainless steel. The buffer material 5 is wet-molded into the sheet having numerous holes 7 on its surface by blending quartzite having thermal expansion properties, inorganic fiber, and an organic binder. Hence, the quartzite contained in the buffer material 5 expands when this entire structure is heated to approximately 400°C, shrinking the ceramic honeycomb 1 in the radial direction. The two ends of the container 6 are narrowed into a tapered form, one end constituting the engine connection opening 8 and the other end the muffler connection opening 9. Inside the container 6, stoppers 10a and 10b are welded so as to anchor the buffer material 5 in front of and behind the ceramic honeycomb 1.

Next, the operation in the constitution of this working example is explained. First, the normal operation of the diesel engine is explained. Exhaust gas containing particulates is made to flow into the aforesaid engine connection opening 8 connected to the exhaust pipe of the diesel engine by the operation of the engine. The exhaust gas then enters the cell 2a formed on the engine connection opening 8 side, there passes through the cell wall 3, and enters the cell 2b which opens into the muffler connection opening 9. At this time, the particulates contained in the exhaust gas are held and accumulate in the cell 2a

which opens into the engine connection opening 9 side without passing through the cell wall 3. Meanwhile, the clean exhaust gas from which the particulates have been removed enters the muffler connection openings 9, passes through the muffler, and is discharged into the atmosphere. While the operation of accumulating particulates is continued in this way, the passage resistance of the ceramic honeycomb 1 gradually increases due to clogging by particulates, and the increased back pressure works to press the ceramic honeycomb 1 backward. However, the ceramic honeycomb 1 is continuously held resisting this force by the high degree of frictional force operating between the outside of the ceramic honeycomb 1 and the surface of the buffer material 5 having numerous holes. Then, when a sufficient quantity of particulates has accumulated inside the ceramic honeycomb 1, reaching the stage at which further accumulation would have a harmful effect on the engine, a regeneration process is induced. In regeneration, first the air opening of the diesel engine is choked, and the engine is placed in the state of excessive load. When this state has been maintained for approximately 5 min, the exhaust gas temperature reaches 600°C or above. The interior of the ceramic honeycomb 1 also reaches a temperature of approximately 600°C, and the particulates which have accumulated therein begin combustion. The interior temperature of the ceramic honeycomb 1 due to the heated combustion reaches a range of 800°C to 1000°C. The outside of the ceramic honeycomb 1 radiates heat out of the container 6 through the buffer material 5, but the quantity thereof can be held to a comparatively low level due to the air insulation of the numerous holes in the buffer material 5. Accordingly, the temperature differential between the center portion and the outer

portion of the ceramic honeycomb 1 can be maintained to within 200°C, and mechanical deformation occurring on the outside due to thermal expansion in the center portion can be held to a low level.

As a result, the ceramic honeycomb 1 is not easily damaged even when pushed downstream in the vessel 6. Moreover, cracking does not occur in the outer portion of the ceramic honeycomb 1, and there is no breakage even under usage conditions where placed in exhaust gas of an internal combustion engine and subjected to repeated sudden heating.

In the buffer material 5, by forming the numerous narrow grooves 11 on the surface as shown in Figure 2 diagonal to the axis of the ceramic honeycomb 1, an effect similar to that described above is obtained.

(Effects of the Invention)

By means of the present invention, by forming numerous holes or fine grooves in the surface of the buffer material that is interposed between the ceramic honeycomb and the container which houses it, [illegible] force sufficient to resist back pressure caused by exhaust gas can be provided. Furthermore, by means of the air or insulation produced on the cross section of the buffer material, the amount of heat radiated out can be held to a low level, the temperature differential produced between the interior and exterior of the ceramic honeycomb can be reduced, the deformation caused by tensile force in the axial direction undergone by the external portion as a result of thermal expansion of the interior can be held to a minimum, and cracking in the external portion can be prevented.

4. Brief Explanation of the Figures

Figure 1 is a longitudinal cross section of a structure for exhaust gas purification, Figure 2 is a perspective drawing showing the state during the assembly of the exhaust gas purification structure of another working example of the present invention.

1... ceramic honeycomb, 4... plug, 5... buffer material, 6... container, 7... holes, 11... grooves

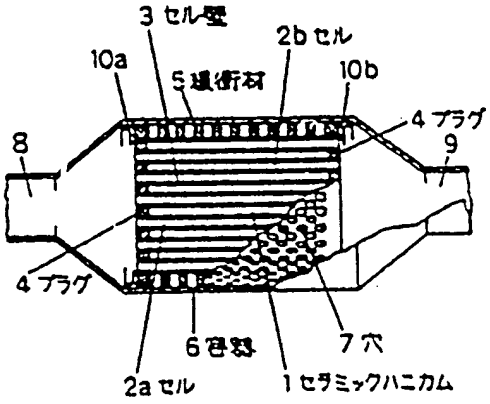

Figure 1
1: ceramic honeycomb
2a,2b: cell
3: cell wall
4: plug
5: buffer material
6: container
7: holes

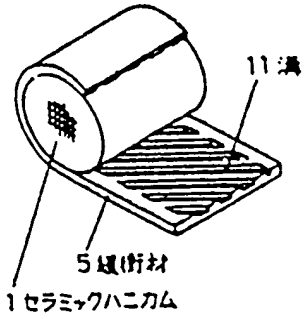

Figure 2
1: ceramic honeycomb
5: buffer material
11: grooves